

THE PATHOLOGICAL EFFECTS
PRODUCED BY *STRONGYLOIDES*
IN A CHIMPANZEE

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PLATE XIII

The animal first came under our observation on 11th January, 1922, at which time it was suffering from dysentery. The faeces were examined on the 11th and 12th January, but no ova or larvae were found. On 5th February the animal had a mild attack of diarrhoea, and numerous rhabditiform larvae of *Strongyloides* were found in the faeces; no blood was passed. After 5th February the animal showed no intestinal symptoms of any kind; it remained under our observation for malaria till its death on 23rd February. On February 23rd, at 8.30 a.m., the animal appeared well and made a good meal. At noon the same day it was found lying in its cage in a condition of collapse and breathing with difficulty; it had vomited a large quantity of bile-stained material; death occurred in half an hour.

POST-MORTEM EXAMINATION

MACROSCOPIC.

The cause of death appeared to be innumerable small recent haemorrhages uniformly distributed over the whole surface of both lungs (Plate XIII, fig. 1). The only other lesion found

in the lungs was emphysema along the inner margins of the lower lobes of both lungs. The vessels on the surface of the brain were dilated. The pericardium contained about an ounce of fluid. The jejunum, from a point about twelve inches below the pylorus, was thickened throughout its whole circumference for a distance of five inches (Plate XIII, figs. 2-4). In this part the gut wall was about 8 mm. thick, as compared with about 3 mm. in the normal part of the jejunum; the mucosa over the whole affected area was friable. At the commencement of this thickened area there was a conical tumour projecting into the lumen of the gut. The base of this tumour was about 3 cm. in diameter, and its apex projected 1·5 cm. into the lumen of the gut. No other lesions were found in the gut.

MICROSCOPIC.

Filariform *Strongyloides* larvae were found in lung smears (Text-fig. 1). Sections of the lung showed emphysema in the



FIG. 1. Filariform larva of *Strongyloides* in the lung.

immediate neighbourhood of the haemorrhages. This emphysema was probably acute following on the haemorrhages and dyspnoea. Filariform *Strongyloides* larvae were found in scrapings of the mucous membrane of the trachea and bronchi. Rhabditiform larvae were present in the trachea, but these were derived from vomited material drawn into the trachea before death. Filariform *Strongyloides* larvae were also discovered in blood from the right ventricle, in the pericardial fluid, in the liver and spleen.

The size of the larvae varied in length from 0·324 mm. to 0·442 mm., and in width from 0·016 mm. to 0·022 mm.

No larvae were found in the brain, and the vascular dilation was probably due to the dyspnoea preceding death.

Examination of sections of the affected part of the jejunum showed thickening due to a large increase in lymphoid tissue in the mucosa, and still more in the sub-mucosa; the muscular layers and serous coat were thickened and showed small-celled infiltration. Innumerable adult worms were present, many projecting into the lumen of the intestine, but the majority were buried deep in the mucosa (Text-fig. 2). In many parts the epithelium of

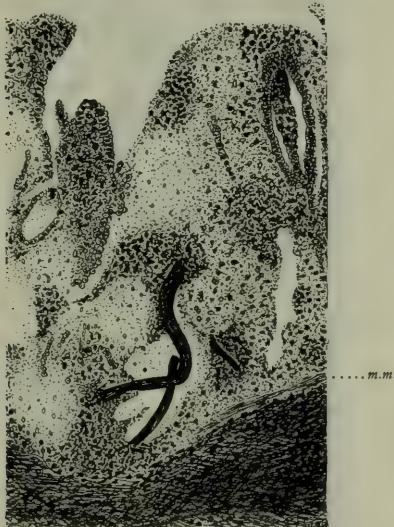


FIG. 2. Adult worm lying above the muscularis mucosae (*m.m.*). \times c. 300.

Lieberkühn's crypts was destroyed, apparently through the mechanical agency of the worms. Adult worms were also found in the sub-mucosa (Text-fig. 3) down to the level of the circular muscle coat. Empty worm spaces were seen both in the mucosa and in the sub-mucosa. The worms evidently possess the power of moving through the muscularis mucosae, as some were found projecting through it externally into the sub-mucosa and internally into the

mucosa. In spite of the movement of the worms in the tissue, only very few small haemorrhages were found. Ova with developed embryos were present near the surface and throughout the mucous membrane.



FIG. 3. Parts of adult worms and ova above the muscularis mucosae, and of adult worms beneath the muscularis mucosae (*m.m.*). \times c. 300.

The tumour on section was found to consist of a core of muscle tissue. This core was surrounded by a thick layer of lymphoid tissue extending up to the muscularis mucosae. The mucosa and

lymphoid tissue beneath the muscularis mucosae contained numerous adult *Strongyloides*. Adult worms were found adjacent to the muscular core of the tumour; there is, therefore, evidence here that the presence of *Strongyloides* in the sub-mucosa may cause hypertrophy, and even tumour formation.

Adult *Strongyloides* and rhabditiform larvae were found free throughout the whole alimentary tract from the oesophagus down to the rectum. The presence of free adults is attributed to the friable state of the infected part of the gut, those above the lesion being carried up by the severe vomiting which preceded the death of the animal. The size of the adult worms varied from 1·8 mm. to 2·5 mm. by 0·044 to 0·057 mm.

There are several points of interest in the case of this chimpanzee.

(1) During its attack of dysentery, when it was passing blood and mucus, no larvae were found on two successive days.

(2) In spite of a heavy infection, there was no diarrhoea present from 16th January to 5th February, and from 5th February till its death on 23rd February.

(3) The gross lesions in the jejunum were altogether out of proportion to the signs and symptoms, which were slight. It is probable that in some human infections where symptoms are not marked the lesion in the intestine may yet be gross.

(4) The depth at which the worms were found in the intestinal wall seems to preclude the possibility of affecting the worms by the usual helminthocides administered orally. The cures reported by various authors from time to time depend probably on the fact observed in this case that, even with a very heavy infection and considerable damage to the gut, larvae are not always present in detectable numbers in the faeces. Another possible explanation is that those observers were dealing with a slight infection in which the worms were comparatively superficial.

(5) The animal was kept in a wooden box (4 ft. by 3 ft. by 2½ ft.) with a grating on one side placed in the open air. The box was swept and washed out with water daily. The larvae in sufficient numbers to have caused a fatal invasion must have lodged in the crevices of the moist wood.

(6) The invasion must have gone on for several days since larvae were found both in the heart's blood and trachea.

SUMMARY

A chimpanzee which died suddenly was found to have numerous recent haemorrhages in both lungs.

The haemorrhages were found to be due to filariform *Strongyloides* larvae. Larvae were found in the lungs, trachea and bronchi, in the heart's blood, in pericardial fluid, in the liver and spleen.

A heavy infection of *Strongyloides* was found in the jejunum, where a tumour, probably caused through irritation, was present. Adult *Strongyloides* were found at all levels down to the circular muscle layer.

EXPLANATION OF PLATE XIII

- Fig. 1. Lung : portion of the inferior surface of the lower right lobe, showing many circular haemorrhages.
- Fig. 2. Tumour of the jejunum and part of gut affected by *Strongyloides*. Natural size.
- Fig. 3. Normal thickness of the jejunum of the same animal.
- Fig. 4. Surface view of part of affected gut with portion of the tumour on left. Slightly enlarged.